临床研究

非糖尿病人群腰臀比和慢性肾脏病的相关性

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摘要:目的 分析非糖尿病人群中腰臀比与慢性肾脏病的相关性,比较其在男性和女性中的差异。**方法** 选择2012年6月~10月我国南方社区居民进行横断面筛查(n=2142),排除糖尿病人群。将参与者分为男性组和女性组,并以腰臀比四分位数将男女各分为4组。采用Logistic回归模型分析在非糖尿病人群中腰臀比与慢性肾脏病的相关性,并比较其在男性和女性中的差异。**结果** 在女性非校正模型中,腰臀比与慢性肾脏病显著相关(OR 7.29,95% CI 3.56 to 16.32,P<0.001)。在校正潜在混杂因素如年龄、高血压史、冠心病史、吸烟饮酒史、收缩压、舒张压、甘油三酯、高密度脂蛋白后,二者仍相关(OR 6.13,95% CI 2.56 to 15.20,P=0.003)。在男性非校正模型中,腰臀比四分位数最高与最低组慢性肾脏病与腰臀比的OR值为2.44(95% CI,0.98 to 4.97,P=0.103)。**结论** 在非糖尿病人群中,女性腰臀比是慢性肾脏病独立危险因素,在男性中无相关性。
关键词:腰臀比;慢性肾脏病;性别;非糖尿病人群

Association of waist-to-hip ratio with chronic kidney disease in non-diabetic subjects

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Abstract: Objective To explore the relationship between waist-to-hip ratio (WHR) and chronic kidney disease (CKD) in non-diabetic subjects and compare the difference between male and female subjects. **Methods** We performed a cross-sectional survey among 2142 community-based southern Chinese participants without diabetes from June to October 2012. We divided all the participants into 4 groups according to the gender-specific quartiles of WHR. Logistic regression models were used to explore the associations of WHR with CKD in these subjects. **Results** In the unadjusted model, WHR was significantly associated with CKD in women (OR=7.29, 95% CI: 3.56-16.32, P<0.001), and the association was still significant (OR=6.13, 95% CI: 2.56-15.20, P=0.003) after adjustment for the potential confounders (including age, history of hypertension, coronary heart disease, current smoker, physical inactivity, education level, systolic blood pressure, diastolic blood pressure, serum triglyceride, serum high density lipoprotein, blood glucose, and BMI). The odds ratio (OR) for having CKD in the highest versus lowest quartile of WHR levels was 2.44 (95% CI: 0.98-4.97, P=0.103) in men in the unadjusted model. **Conclusion** WHR levels are associated with CKD in non-diabetic women but not in non-diabetic male subjects.
Key words: waist-to-hip ratio; chronic kidney disease; gender; non-diabetic subjects

慢性肾脏病(CKD)已成为危害公众健康的重要危险因素[1-2]。最近一项研究表明,我国CKD的患病率为10.8%[2]。随着肥胖人群的增加[3-7],肥胖与高血压、冠心病、糖尿病及CKD等的关系逐渐被认识[8-10]。肥胖,尤其是中心性肥胖是引起肾脏病进展的危险因素,肾移植术前肥胖也是移植后肾失功的危险因素[11]。体质量指数(BMI)是用于临床诊断肥胖的常用指标,但是近年来研究发现,BMI检测CKD肥胖患者效果欠佳。BMI不能辨别脂肪或肌肉的重量,也不能区分脂肪的分布[12],而腰臀比(WHR)是用来诊断中心性肥胖的良好指标[13]。

CKD与WHR的关系研究仍然存在争议。一些研究认为,WHR,作为中心性肥胖和内脏脂肪的一种检测指标,几乎不被肌肉质量所影响,可以用来更好的诊断肥胖,WHR与CKD的发生率和死亡率相关[14-16]。然而Burton等[17]的研究表明CKD与腰围、BMI显著相关,与WHR无相关性。在非糖尿病人群中WHR与CKD的关系研究较少。本研究通过对珠海市湾仔社区原住居民进行流行病学调查,探讨在非糖尿病人群中WHR和CKD的相关性,并比较其在男性和女性中的差异。

1 资料和方法

1.1 研究对象

选择2012年6月~10月在珠海市湾仔社区居住≥10年且具有本地户籍的18岁以上居民2142例。纳入标

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准:参与者行口服葡萄糖耐量实验(OGTT),了解患者糖代谢情况,将无糖尿病病史,且空腹血浆葡萄糖(FPG)<6.1 mmol/L 或 OGTT 2 h 血浆葡萄糖(2 h PG)<11.1 mmol/L的非糖尿病者纳入研究范围,最终纳入研究的有1508人。其中男性542例,女性966例。

1.2 方法

由专业医护人员对参与者进行询问、填写问卷调查,记录所有研究对象的性别、年龄、病史、家族史、生活习惯等。完成信息登记的居民安排下一步体格检查及采血、留取晨尿。体检当天对来检居民进行身高、体质量、腰围、臀围、血压值的测量。留取晨尿,检测尿白蛋白和肌酐并计算其比值(ACR);另空腹抽血检测血清肌酐、尿酸、血糖、胰岛素、血脂等,应用CKD-EPI方程估算肾小球滤过率(GFR)。

1.3 诊断标准

CKD诊断标准:参照美国KDIGO指南CKD-EPI方程计算肾小球滤过率(表1)[18]。eGFR<60 mL/min或者ACR≥30 mg/g(≥3 mg/mmoL)并持续3个月或以上诊断为CKD。腰围以腋中线肋弓下缘和髂嵴连线中点的水平位置为测量点,臀围以臀部(骨盆)最突出部位作为测量点,计算体质量指数(BMI)=体质量(kg)/身高(m),腰臀比=腰围(cm)/臀围(cm)。

1.4 统计学处理

所有参与者根据性别分为两组,每一组根据WHR四分位数各分为四小组(Q1-Q4)。采用SPSS 19.0统计软件包对数据进行统计学分析。连续变量正态分布资料以均数±标准差表示,连续变量非正态分布资料以中位数(25百分位数~75百分位数)表示;分类变量采用绝

表1 男性以WHR四分位数间距分组的基本特征

Tab.1 Baseline characteristics of the male subjects according to WHR quartiles

Characteristics	WHR				*P*
	Quartile one (<0.87)	Quartile two (0.87-0.91)	Quartile three (0.92-0.95)	Quartile four (>0.95)	
Age (year)	47.02±16.65	51.70±15.00	53.82±13.52	54.78±14.30	<0.001
History of hypertension (%)	16 (10.6)	29 (21.8)	31 (23.5)	38 (30.2)	0.003
History of coronary heart disease (%)	0 (0)	2 (1.5)	5 (3.8)	3 (2.4)	0.118
Current smoker (%)	67 (44.7)	62 (47.3)	55 (41.7)	59 (47.6)	0.752
Physical inactivity (%)	97 (67.8)	89 (70.6)	77 (59.2)	71 (59.2)	0.121
Educational status (>high school) (%)	86 (58.5)	71 (57.3)	59 (45.0)	54 (43.9)	0.023
SBP (mm Hg)	120.52±17.28	126.15±18.09	131.40±16.50	132.57±17.14	<0.001
DBP (mm Hg)	74.31±9.42	77.38±9.55	79.71±9.65	81.61±9.57	<0.001
BMI	21.39±2.85	23.72±3.32	23.85±2.59	25.44±3.28	<0.001
SCR (μmol/L)	85.24±11.78	87.97±13.58	87.92±16.92	88.16±17.22	0.287
GLU (mmol/L)	4.56±0.41	4.61±0.39	4.70±0.41	4.79±0.44	<0.001
Uric acid (μmol/L)	385.09±79.16	405.47±90.93	411.14±78.93	430.55±99.19	<0.001
eGFR (mL/min)	93.42±16.21	84.09±17.23	86.97±18.87	91.11±23.30	0.085
ACR (mg/moL)	0.63 (0.47-1.05)	0.67 (0.46-1.16)	1.17 (0.56-2.60)	0.78 (0.57-1.29)	0.120
CRP (mg/L)	0.57 (0.27-1.12)	0.96 (0.55-2.35)	1.17 (0.56-2.60)	1.69 (0.72-3.60)	<0.001
TG (mmol/L)	1.28±0.79	1.66±1.04	1.63±1.03	1.97±1.15	0.005
LDL (mmol/L)	2.97±0.91	3.17±0.79	3.16±0.94	3.25±0.96	<0.001
HDL (mmol/L)	1.51±0.35	1.43±0.30	1.41±0.29	1.35±0.25	0.058
CKD (%)	11 (7.3)	14 (10.5)	8 (6.1)	19 (15.1)	0.076

SBP: Systolic blood pressure. DBP: Diastolic Blood pressure. BMI: Body mass index. SCR: Serum creatinine. GLU: Blood glucose. eGFR: Estimated glomerular filtration. ACR: Urinary albumin to creatinine ratio. CRP: C-reactive protein. TG: Serum triglyceride. LDL: Serum triglyceride. HDL: High density lipoprotein.

对值和相对值比(%)表示。连续变量组间比较采用方差分析。分类变量组间比较采用χ^2检验。采用Logistic回归分析CKD的相关影响因素。P<0.05为差异有统计学意义。

2 结果

2.1 一般情况

1508例参与者纳入研究,平均年龄51.06±14.70岁,542例(36%)为女性,966例(94%)为男性。表1所示,男性WHR四分位数间距分别是Q1:<0.87;Q2:0.87~0.91;Q3:0.92~0.95;Q4:>0.95;表2所示女性WHR四分位数间距分别是Q1:<0.81;Q2:0.81~0.85;Q3:0.86~0.90;Q4:>0.90。在女性,以WHR四分位数间距分为四组,各组CKD患病率分别是4.1%,7.9%,9.9%,21.1%,各组之间CKD患病率差异有统计学意义(P<0.05);在男性,以WHR四分位数间距分为4组,各组CKD患病率分别为7.3%,10.5%,6.1%,15.1%,各组之间CKD患病率无统计学差异(P>0.05)。表1,2所示,在男性和女性,最高四分位数间距的CKD患病率比最低四分位数间距高(男性15.1% *vs* 7.3%;女性21.1% *vs* 4.1%),但是这种差异仅在女性有统计学意义(P<0.05)。

2.2 男性和女性分别以WHR四分位数间距分组的基本特征

表1所示,男性WHR的中位数是0.91。受试者WHR每升高一个四分位数间距,收缩压、舒张压、血清肌酐,尿酸、CRP、甘油三酯水平相应增加(P<0.05)。尿蛋白/尿肌酐值及eGFR在各组间差异无统计学意义(P>0.05)。表2所示,女性WHR的中位数是0.81。随着WHR每增加一个四分位数间距,收缩压、舒张压、血清肌酐,尿酸、CRP、甘油三酯水平相应增加,eGFR相应减低(P<0.05),较高的WHR四分位数间距同时有较高的CKD患病率(P<0.05)。

表2 女性以WHR四分位数间距分组的基本特征

Tab.2 Baseline characteristics of the female subjects

Characteristics	WHR				*P*
	Quartile one <0.81	Quartile two 0.81-0.85	Quartile three 0.86-0.90	Quartile four >0.90	
Age (years)	43.64±14.31	47.94±11.82	53.46±13.42	58.03±13.59	<0.001
History of hypertension (%)	13 (5.3)	27 (10.7)	41 (19.2)	49 (19.1)	<0.001
History of coronary heart disease (%)	2 (0.8)	4 (1.65)	6 (2.8)	5 (2.0)	0.434
Current smoker (%)	24 (10.2)	26 (10.3)	18 (8.6)	21 (8.4)	0.826
Physical inactivity (%)	120 (52.4)	162 (66.4)	114 (56.4)	71 (59.2)	0.121
Educational status ($high school) (%)	119 (51.1)	108 (44.6)	60 (28.7)	60 (24.3)	<0.001
SBP (mm Hg)	115.27±15.44	121.56±17.20	131.89±41.17	141.32±76.75	<0.001
DBP (mm Hg)	71.81±9.08	75.46±9.80	78.22±11.45	80.01±26.00	<0.001
BMI	20.60±2.59	22.47±3.34	22.97±2.94	24.46±3.18	<0.001
SCR (μmol/l)	63.08±8.42	62.89±8.91	65.26±10.67	66.66±13.99	<0.001
GLU (mmol/L)	4.53±0.34	4.63±0.39	4.72±0.37	4.74±0.39	<0.001
uric acid (μmol/L)	295.72±66.28	299.15±76.48	315.58±80.07	341.01±89.06	<0.001
eGFR (mL/min)	101.44±15.42	98.57±14.46	92.31±16.90	88.04±17.48	<0.001
ACR (mg/moL)	0.94 (0.67-1.36)	0.88 (0.39-2.19)	0.99 (0.49-1.97)	1.41 (0.57-3.01)	<0.001
CRP (mg/L)	0.47 (0.26-1.06)	0.96 (0.55-2.35)	1.17 (0.56-2.60)	1.69 (0.72-3.60)	<0.001
TG (mmol/L)	0.94±0.40	1.24±0.82	1.43±0.75	1.61±0.93	<0.001
LDL (mmol/L)	2.89±0.81	3.16±0.84	3.26±0.93	3.31±0.90	<0.001
HDL (mmol/L)	1.71±0.34	1.59±0.27	1.57±0.31	1.60±0.31	<0.001
CKD (%)	10 (4.1)	20 (7.9)	21 (9.9)	54 (21.1)	<0.001

SBP: Systolic blood pressure. DBP: Diastolic blood pressure. BMI: Body mass index. SCR: Serum creatinine. GLU: Blood glucose. eGFR: Estimated glomerular filtration. ACR: Urinary albumin to creatinine ratio. CRP: C-reactive protein. TG: Serum triglyceride. LDL: Serum triglyceride. HDL: High density lipoprotein.

2.3 WHR与CKD的关系在性别间的差异

在多因素Logistic回归模型中，以有无CKD作为二分类因变量，WHR四分位数作为等级变量带入回归模型，Model 1为未校正模型；Model 2为校正高血压史、冠心病史、吸烟、锻炼，文化程度混杂因素；Model 3为校正高血压史、冠心病史、吸烟、锻炼、文化程度、收缩压、舒张压、甘油三酯、高密度脂蛋白、空腹血糖、BMI。表3所示，男性Q1-Q4类间比较均无统计学差异（P>0.05），在男性WHR可能不是CKD的危险因素。表4所示，在女性未校正模型Model 1中，与最低四分位数Q1组相比，Q2、Q3、Q4组的CKD患病率显著增加（OR 3.02，P=0.084；OR 3.26，P=0.018；OR 7.29，P<0.001）。在校正高血压史、冠心病史、吸烟、锻炼，文化程度混杂因素后，相对于最低四分位数组，最高四分位数组OR达4.01（P=0.002）；在此基础上继续校正收缩压、舒张压、甘油三酯、高密度脂蛋白、空腹血糖BMI后，与最低四分位数组相比，最高四分位数组OR值也达6.13（P=0.003）。女性WHR与CKD独立相关。

表3 男性WHR和CKD之间的关系

Tab.3 Association between WHR and CKD in the male subjects

Quartiles of WHR	Modle one[a]		Modle two[b]		Modle three[c]	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Quartile one	Reference		Reference		Reference	
Quartile two	0.67 (0.29-1.53)	0.339	0.89 (0.33-2.37)	0.813	0.85 (0.23-2.83)	0.792
Quartile three	1.22 (0.48-3.13)	0.682	1.91 (0.65-5.62)	0.240	5.23 (1.17-8.90)	0.301
Quartile four	2.44 (0.98-4.97)	0.103	0.64 (0.26-1.59)	0.337	1.50 (0.29-3.62)	0.979

[a]Unadjusted; [b]adjusted for age, history of hypertension, coronary heart disease, current smoker, physical inactivity, education attainment; [c]adjusted for above + systolic blood pressure, diastolic blood pressure, serum triglyceride, serum high density lipoprotein, blood glucose, BMI.

表4 女性WHR和CKD之间的关系

Tab.4 Association of WHR with CKD in the female subjects

Quartiles of WHR	Modle one[a]		Modle two[b]		Modle three[c]	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Quartile one	Reference		Reference		Reference	
Quartile two	3.02 (1.85-4.23)	0.084	2.85 (1.76-5.89)	0.232	3.32 (1.57-6.09)	0.236
Quartile three	3.26 (1.99-7.04)	0.018	2.27 (1.09-5.60)	0.262	3.07 (1.42-5.78)	0.280
Quartile four	7.29 (3.56-16.32)	0.000	4.01 (2.13-7.88)	0.002	6.13 (2.56-15.20)	0.003

[a]Unadjusted; [b]adjusted for age, history of hypertension, coronary heart disease, current smoker, physical inactivity, education attainment; [c]adjusted for above + systolic blood pressure, diastolic blood pressure, serum triglyceride, serum high density lipoprotein, blood glucose, BMI.

3 讨论

近年来，CKD患病率不断升高，众所周知，随着生活质量的提高，肥胖发生率>20%，在21世纪达到了爆炸时期[10]。目前影响CKD患病率的危险因素主要有高血压、糖尿病、冠心病等[19]，而最近研究发现肥胖也是影响CKD的重要危险因素，中心性肥胖比周围性肥胖对于健康的影响更大[20]。中心性肥胖的人体测量指数与代谢疾病和慢性疾病显著相关[21]。亚洲一项前瞻性调查研究发现，中心性肥胖与下降的肾功能显著相关，然而BMI与肾功能无关系[22]。WHR被认为是中心性肥胖的一项诊断指标，优于BMI，BMI并不能完全反映脂肪在腹部的分布，不能把肌肉、骨骼及液体与脂肪、内脏脂肪与皮下脂肪及中心性肥胖与外周性肥胖区别开来，而CKD主要与肌肉质量的减少有关，因此BMI并不适用于作为CKD患者评估肥胖的指标，WHR主要是反映脂肪在腹部和臀部的分布情况，提示腹壁脂肪与内脏脂肪的堆积程度，更能准确地预测肥胖，尤其是中心性肥胖[20]。

Kwakernaak等[16]研究表明WHR与低血浆流量和低eGFR相关，这种相关性独立于BMI。田延红等选择167例正常人做对照，179例为CKD患者，采用多因素Logistic回归分析，结果表明，相对于WC和BMI，WHR对预测CKD的发生具有一定优势[23]。这和本研究结果

相似。然而,Burton在非糖尿病人群中研究人体测量指标与CKD的关系,研究结果发现CKD与腰围(WC)、BMI独立相关(P<0.01),与WHR不相关(P>0.05)[17]。一项随访了7年的队列研究包括3107名受试者显示,BMI、WC与CKD独立相关,而WHR不相关[24];另一项研究表明在男性和女性,WC和BMI与eGFR独立相关,但是WHR仅在男性与eGFR相关[25]。Chou等[11]的研究显示WHR与CKD的关系在性别间无差异(P<0.05)。总之,WHR与CKD的关系在性别间的差异性仍然存在争议。本研究发现,在女性,排除BMI等混杂因素后,WHR仍是CKD的危险因素,WHR与降低的eGFR相关,然而在男性显示WHR与CKD无相关性。这可能与性激素有关系,由于性别差异,随着年龄的增大,男性和女性脂肪再分布方式表现不同,中心性肥胖的增加与性激素水平的下降有关系[23]。女性月经的中断导致性激素水平的急剧下降,而男性性激素水平以一种平稳缓慢的方式衰减,女性这种性激素显著地下降直接或间接的引起脂肪再分布,从外周转移到腹部形成中心性肥胖,从而导致女性心血管事件和CKD危险增高。

本研究从流行病学的角度为WHR与CKD关系及其在性别间的差异性研究研究提供了更多的依据,丰富了亚洲人群的相关资料为慢性病的防治及政府决策提供了指导。),但由于本研究是一个横断面的调查,抽样人群的数量有限,随机样本仅有一定代表性,不排除选择性偏差,例如仅36%为男性,因此有必要进行长期的前瞻性研究,以明确WHR预测CKD的价值及其在性别间的差异。

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